DOCUMENT RESUME

ED 210 495 CE 030 764

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TITLE Designing and Implementing a Computerized Information Management System for Employment Demand Data in Agriculture/Agribusiness.
PUB DATE [81]
NOTE 10p.; Paper presented at the Annual Convention of the American Vocational Association (Atlanta, GA, December 1981).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Agribusiness; *Agricultural Occupations; Data Collection; Demand Occupations; Educational Planning; Employment Opportunities; *Employment Projections; Higher Education; *Information Needs; Information Processing; Information Retrieval; Information Storage; *Information Systems; Job Training; Labor Market; *Labor Needs; Occupational Information
IDENTIFIERS Cornell University NY; Dictionary of Occupational Titles; Occupational Information System

ABSTRACT

Planning for educational programs in agriculture/agribusiness demands knowledge of future employment demand for various occupations. At present, a functional and comprehensive occupational information system for agriculture/agribusiness does not exist. Systems that do exist, such as the Occupational Information System (OIS) and the Dictionary of Occupational Titles (DOT) occupational classification system, do not accurately convey the myriad of job titles represented in agriculture/agribusiness, nor provide reliable projections of future demands for these occupations. A project at Cornell University attempted to create a comprehensive system for agriculture/agribusiness. Agricultural employers in New York State were surveyed, and information on job titles obtained from the survey was correlated with OIS job title codes and DOT codes wherever possible. The project provided survey data and job title lists on magnetic tape, accessible by several approaches. These files provide data for researchers and for refinements of the DOT and OIS systems and a beginning stage of the comprehensive computerized occupational information system in agriculture/agribusiness that is needed for future education planning. (KC)

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DESIGNING AND IMPLEMENTING A COMPUTERIZED INFORMATION MANAGEMENT SYSTEM FOR EMPLOYMENT DEMAND DATA IN AGRICULTURE/AGRIBUSINESS

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INTRODUCTION AND OVERVIEW

Agriculture/agribusiness is a major industry in the United States as evidenced by food exports of over 300 billion dollars in 1980. In New York State, agriculture/agribusiness represents the single largest industry in terms of dollar value of goods and services produced. Educational program planning to prepare persons for this industry thus becomes an endeavor for emphasis.

Comprehensive employment demand data are needed for educational program planning in agriculture/agribusiness. Such employment demand data must reflect not only the immediate employment needs of the marketplace, but long-term employment needs as well. It must be concerned with emerging and obsolescing occupations and professions, as well as relevant industries moving into and out of the states. It must be sensitive to shifts in types of clientele that given industries may serve in response to economic pressures. For example, the New York State insurance division of Agway (an interstate agricultural cooperative) now serves non-farm clients and no longer requires a majority of its employees to possess agricultural competencies. To be effective for program planning, employment data should also reflect the changing knowledge and skills that may characterize on-going occupations. For example, more and more dairy farm operations are computerized, and the successful manager or owner/operator needs programming skills. It would be most helpful, from the point of view educational program planning, to know how much education is required to achieve competence.

Only part of these information needs have been met as the various parts of an Occupational Information System (OIS) are developed in response to a mandate of the Vocational Education Amendments of 1976. The OIS is to provide supply and demand data to various federal and state sectors including vocational education. The intent is to provide employment demand data in sufficient detail to assist with the educational program planning that provides an appropriate supply of trained workers to meet the demand. The same Amendments created NOICC (National Occupational Information Coordination Committee) to provide the leadership for the development of an OIS by working with the SOICC (State Occupational Information Coordination Committee) in each state.

The National Center for Education Statistics (NCES) collects student enrollment information from all the states and territories which is aggregated by instructional program codes. These data are collected through VEDS, the Vocational Education Data System developed by NCES. This reporting system is intended to provide supply data for the OIS at both the state and national levels. The VEDS further classified program leavers whether graduates or not by two-digit SOC (Standard Occupational Classification) codes depending on the type of employment they obtained after existing from school. How this two-digit information is to be used relative to demand information is unclear.

A number of efforts have been undertaken to supply current and projected employment demand data as a prerequisite for planning educational programs that prepare people for positions within the agriculture/agribusiness industry. Serious efforts at the federal and state levels to provide these data have been made by the Bureau of Labor Statistics (BLS) of the Department of Labor (DOL), and by NOICC and the SOICCs. Under the direction of Marcus Einstein, staff in the BLS prepared and field-tested techniques to compile demand data for agriculture/agribusiness occupations from state files maintained by State Employment Security Agencies. However, these data are "on number of workers in selected occupations for 1974 with projections for 1985."[1] The national projections on agribusiness jobs developed by BLS and the set of procedures for developing similar projections for states were sent to the SOICC directors by the executive director of the NOICC. Assistance from the SOICCs was requested to develop state tabulations with the help of vocational education staffs.[2]

The NOICC has "adopted the Occupational Employment Statistics Program (OES) of the U. S. Department of Labor as the standard principal source of current and projected employment demand data at the local, state, and national level."[3] The OES develops demand data on current and projected need for occupations by industry. Demand projections for five and ten years ahead are done using the OES I/O (Industrial/ Occupational) Matrix. Projections are provided by applying economic factor assumptions to a matrix of current demand data in each of the cells of the I/O matrix. However, the OES survey, which is presently the most sophisticated, timely and comprehensive survey of employment demand data extant, does not include on-farm information. The NOICC funded "A Study of the Issues Related to the Collection of Occupational Employment Data in Agriculture" to address the problems of collecting such data and to make recommendations for acquiring relevant information. Page Birdsall, who conducted the study, limited it to the issues concerned with "occupational data on farm employment," particularly "SIC 01 and 02, Agricultural Production, Crops and Livestock, and SIC 07, Agricultural Services."[4] Many of the problems she identified in this study apply to other SICs as well.

There are still many unresolved problems despite the considerable data yield of the OES. One limitation from the point of view of adequate and extensive educational program planning concerns the list of occupations included in agribusiness. For example, the selected occupations determined by the National Committee on Employment Opportunities in Agriculture and Agribusiness (a federal interdepartmental committee represent-

ing the U. S. Departments of Agriculture, Labor and Education) do not include a majority of the over 600 job titles identified for New York State by the Cornell study on employment demand in agriculture/agribusiness. This same study initially identified over 3,000 job titles applicable to the industry from a review of state studies, the DOT, and other sources. A further concern is that lists of occupations such as that developed by the National Committee are not only limited in scope but also lack provisions for up-dating. The time and costs required for up-dating committee developed lists are considerable. The changing nature of the agriculture/agribusiness industry, a characteristic to which educational program planning needs to be responsive, requires timely information on job titles in current use by employers.

Additionally, the issues and problems endemic to multiple, non-matching classifications of occupational titles and industries are still not resolved. A review of the literature indicates that in response to the need for employment demand data more consistent with the information requirements of educational program planning, at least 26 states have conducted over 50 studies of agriculture/agribusiness employment demand since 1970. The problems inherent in defining appropriate business areas, job titles, and data sources were not resolved by these studies in ways that are transferable from one state to another. The development of the Occupational and Educational Code Crosswalk[5] is the most comprehensive effort to date that addresses these issues. But it is not yet at the stage where it contains sufficient information on an extensive enough list of occupations to be used for comprehensive program planning. The Crosswalk contains SOC codes which are not widely used. Further, the SOC handbook[6] causes problems when used for job classification. The same job title may be classified under two different SOC codes. One SOC code may contain "overlaps in the coding system. An example is code 5617 which includes dairy workers, poultry workers, and most livestock handlers."[7] The Crosswalk also used three-digit DOT industrial codes whic correlate poorly with the more highly differentiated four-digit SIC (Standard Industrial Classification) codes. The SIC codes are presently the only industrial code index to the ES202 file (unemployment insurance file of the U. S. Department of Commerce), an extensive data source stratifiable by number of employees per employer. Additional problems are that many of the job titles listed in the Crosswalk have DOT numbers but do not have OES codes so that the OES matrix is not usable for such job titles; further, the OE codes with which the job titles are identified were replaced in February 1981 with new instructional program codes. Development of a conversion table for these two different classifications is planned.

Another problem hinges on the fact that a great many job titles such as those identified in the Cornell study either do not have DOT numbers or are not accurately described in the DOT For example, the title "Owner/operator" is not listed in the 4th Edition of the DOT, yet it has a very high frequency of occurrence across a wide variety of business areas.

Further, the review of the literature conducted in the Cornell study found that no study has yet addressed the issue of determining emerging and obsolescing industries and occupations which must be a concommitment of long-range planning.

Finally, the scope and complexity of agriculture/agribusiness necessarily involves employment demand data on a very large variety of occupations. Thus, a computerized information management system is needed in order to manipulate extensive collections of data on large numbers of job titles. Also of importance is that computerization makes it possible for staff in other states to readily select business areas and job titles from a list that has already been coded by DOT and SIC, and to add to the file the additional titles that may be unique to individual states.

THE CORNELL APPROACH TO INFORMATION MANAGEMENT

Information management was conceptualized in the Cornell study as a four-fold process: (1) the location and acquisition of data; (2) the preparation and storage of the data: (3) the sorting, merging and analysis of data: and (4) the presentation of data in formats useful to intended audiences. Given this four-fold context and the current limitations of the OIS described above, the Cornell study was concerned with the requirements for an employment demand system for agriculture/agribusiness in New York State that could be updated for purposes of educational program planning. Toward this goal the following objectives were addressed·

1. To collect employment demand data on as comprehensive a list of job titles as possible within resources of the study.
2. To reflect occupational terminology used by employers.
3. To articulate with existing efforts of the Occupational Information System operative at the federal and state levels.
4. To create data files and procedures for periodic updating of employment demand in agriculture/agribusiness for New York State.
5. To explore the cost-effectiveness of various forms of data collection procedures.

Location and Acquisition of Data

To meet these objectives, three kinds of data bases were developed. The first was the identification of a comprehensive list of job titles requiring agricultural competencies. The second was the identification of firms and data sources from which employment demand data could be collected. The third type, the collected employment data, is discussed in the next section, "Preparation and Storage of Data."

The first data base was compiled from the fourth Edition of the DOT and from over 60 employment demand studies conducted since 1970. Over 2,700 job titles were identified and screened for applicability to New York State. This large compilation, coded by DOT number and four-digit SIC code, is available on magnetic tape from the New York State Education Department.

The second data base was determined by delineating the segments of the agriculture/agribusiness industry to be studied. Approximately 120 business areas, e.g., retail florist, were selected for coverage.

A business area may be the same as an SIC code, e.g., retail florist, or several business areas may be included under a single SIC code,

e.g., retail nurseries and farm and garden stores. A decision was made based on available resources to limit the study to those business areas directly (1) supplying goods and service to production agriculture, or (2) processing and distributing the products of production agriculture. Examples of these "Stage I" business areas are "retail machinery dealership" and "food processor" shown in Figure 1.

Job titles from the comprehensive list were screened for their applicability to the selected business areas for New York State which resulted in a much smaller number of applicable titles. This reduced list was screened for duplication and specificity of job function. Additions were made to reflect all levels of responsibility. Titles in the refined list were those used in survey instruments developed to collect demand data from employers in the different business areas.

After the business areas and applicable job titles were identified, a determination was made concerning (1) the identification of SIC codes suitable for data collection using employer listings from the ES 202 tapes, and (2) business areas to be accessed through industry associations' membership lists. Using firm names and addresses identified from both sources, over 15,000 surveys were mailed to the total population of employers. Additional data sources included the agricultural census of 1978 for SIC 01 and 02 occupations, state and federal agency lists, secondary education teacher lists, cooperative extension lists, and post-secondary education teacher lists. In addition, numbers of firms and staffing patterns were determined for six business areas from the Yellow Pages directories for New York State. Staffing patterns were determined for seven strata of directories which were based on the size of the population served by the directory.

Preparation and Storage of Data

The first data base containing the job titles was prepared by assigning either nine-digit DOT or "dummy" occupational codes to every job title. For many job titles there were no assignable DOT codes. A "dummy" number coding system was developed compatible with the DOT, and "dummy" numbers were assigned to such job titles. For project use, a tenth digit was added to the DOT number to identify whether a job title was a base, alternate, or non-DOT title. Thus, in some cases, the same DOT number was assigned to more than one job title. Four-digit SIC codes as applicable were also assigned to each job title. Thus, the job title file could be sorted by DOT number, alphabetically, or by SIC codes. An additional step taken with the files was to assign a fifth digit to the four-digit SIC codes to represent business area differentiations within a given SIC code. For example, SIC code 0181, "Ornamental Horticulture and Nursery Production," was initially differentiated into three business areas: 01811, "Greenhouse Production;" 01812, "Nursery Production;" and 01813, "Christmas Tree Farms." SIC code 8421, "Arboreta, Zoological and Botanical Gardens, Public" was segmented into 84211, "Arboreta and Botanical Gardens" and 84212, "Zoos."

A decision was made to define populations of employers by SIC codes and, if possible, by the five digit SIC/business area codes developed by the study. The five-digit level was helpful in determining applicable job titles but was not found, in most cases, to be helpful in defining

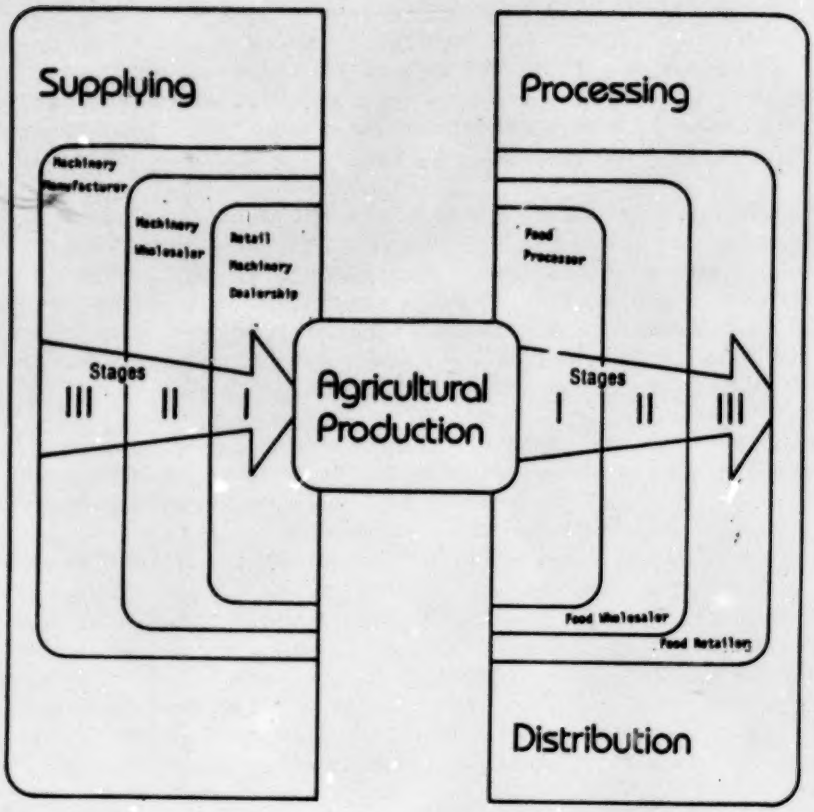

Figure 1. Relationships of Supplying, Processing and Distribution to Production Agriculture

populations from which to sample. In addition, an instructional program code was assigned to each job title on the list. The instructional program code was associated both with an SIC code and the DOT number.

A final step in the preparation of this file was the addition of job titles provided by employers through the survey after such titles had been assigned DOT numbers and instructional program codes. The titles were flagged to identify them as employer additions to the file.

The second major data file, the names and addresses of firms in agribusiness/agriculture, had SIC and county location codes assigned to each firm. In addition, the computer assigned a sequence number to each firm which became that firm's unique identifier. A log was printed out by sequence number to record survey returns and guide follow-up activities.

The third file consisted of data from the employer survey returns. Demand data for thirteen possible computer fields were stored by DOT number in association with the SIC code assigned to a given firm, and by the sequence number assigned to the firm. This sequence number had a two-digit county code appended to it which determined educational planning regions. Job titles were not keyed in, since a job titles file existed from which the names of the job titles could be extracted by accessing the DOT number and SIC code.

There were also two additional small files; one containing the SIC codes and their names, and the other containing the instructional program codes and their names.

Sorting, Merging, and Manipulation of Data

The demand data from the survey returns were aggregated for each of thirteen cells. The data reflected the number of positions and openings for 1980, and anticipated number of openings for 1982. These data were further differentiated by full-time, part-time, and seasonal and year-round. The thirteenth cell contained data on unpaid family labor.

New York State is divided geographically into thirteen educational planning regions and the data was aggregated for each region as well as state-wide.

A follow-up telephone survey to non-respondents was then made to provide a return percentage from which valid projections to the total population by region could be made; and to determine if the non-respondents differed from respondents.

An extrapolation formula to project from returns to the total population was developed based on the number of returns and the total number of firms in the population for each SIC by region. The computer then generated extrapolated totals for each of the thirteen cells. The formula was: for a given educational planning region, the total number of positions/openings for a job title in an SIC is determined by multiplying the total found in the returns by the total number of firms for the SIC in the region, and dividing by the number of firms that returned surveys.

Formatting Data

Three different types of audiences were determined as users of these data and data files. The first audience were the educational planning region planners including those responsible for BOCES, for two-year post-secondary institutions such as the Agricultural and Technical Colleges, and other two-year community colleges. A second audience were the State Education Department's program planners. And the third audience were SOICCs, the NOICC, and the Department of Labor's Bureau of Labor Statistics.

For the first audience, a table was developed which aggregates the data by instructional program for each educational planning region, with an additional table of state-wide totals. For the State Education Department, a 300-page printout was prepared which aggregates the data

for each planning region as well as state-wide, by DOT numbers linked with SIC codes ordered under six-digit instructional program codes. The State Education Department will distribute copies of appropriate segments to interested planners. In addition, printouts were provided of the refined list of job titles in three formats: one ordered alphabetically, a second ordered by DOT number, and a third ordered by SIC code. Each of these three tables also contains six-digit instructional program codes.

For other researchers and for the BLS, the survey data and job titles lists are available on magnetic tape. This allows ready access for the Department of Labor, for example, to extract the dummy number job titles and consider them for inclusion in the DOT. Or, the DOT numbers in the survey data file can be accessed to assign OES codes for inclusion of the data in the I/O matrix to be developed for agriculture/agribusiness.

Additionally, the titles file on tape can provide a ready file of coded job titles to other researchers intending to embark on an employment demand study.

SUMMARY

A functional and comprehensive occupational information system for agriculture/agribusiness does not currently exist. Information management systems for employment demand studies conducted in the interim until such is developed need to be carefully planned in order to further such development and provide interface with the OIS system. The description of the efforts in the Cornell study is intended to contribute toward that end.

FOOTNOTES

1. Letter from Melvin R. Jannsen, Chairman of the National Committee on Employment Opportunities in Agriculture and Agribusiness to Russell Flanders, Executive Director of the National Occupational Information Coordinating Committee. March 6, 1980.

2. Memorandum to SOICC Directors from Russell B. Flanders, Executive Director of National Occupational Information Coordinating Committee. March 7, 1980.

3. Paige Birdsall. A Study of the Issues Related to the Collection of Occupational Employment Data in Agriculture. National Occupational Information Coordinating Committee, December 1980. p. 2.

4. Ibid., p. i.

5. National Occupational Information Coordinating Committee. Vocational Preparation and Occupations, Vol. 1, Occupational and Educational Code Crosswalk. Interim Edition, 1979.

6. U. S. Department of Commerce. Standard Occupational Classification Manual, 1977. Government Printing Office, Washington, D.C., 1977.

7. Kendrick L. Spooner. An Occupational Employment Survey of Agriculture in Colorado. Colorado State Occupational Information Coordinating Committee, January 1981. p. 10.